Vector Equation of a Line

Specification: AQA 7366/7367: F1 · Edexcel 9FM0: Core Pure 6.1

HOMEWORK Consolidation

1 Find a vector equation of the line through $(-4, 2, 7)$ in the direction $\mathbf{i} + 5\mathbf{j} - 2\mathbf{k}$.

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2 Find a vector equation of the line through $A(2, 0, -3)$ and $B(-1, 4, 1)$.

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3 Find the coordinates of the point on the line $\mathbf{r} = \begin{pmatrix} 6 \\ -1 \\ 0 \end{pmatrix} + \lambda\begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix}$ where $\lambda = -2$.

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4 Show that the point $(11, -4, -1)$ lies on the line $\mathbf{r} = \begin{pmatrix} 3 \\ 0 \\ 5 \end{pmatrix} + \lambda\begin{pmatrix} 4 \\ -2 \\ -3 \end{pmatrix}$.

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5 Determine whether the point $(1, 6, 4)$ lies on the line $\mathbf{r} = \begin{pmatrix} -3 \\ 2 \\ 1 \end{pmatrix} + \mu\begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix}$.

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6 The point $(p, q, -9)$ lies on the line $\mathbf{r} = \begin{pmatrix} 1 \\ 4 \\ -3 \end{pmatrix} + t\begin{pmatrix} 5 \\ -1 \\ 2 \end{pmatrix}$. Find p and q.

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7 Find a vector equation of the line through $(0, 3, -2)$ that is parallel to the line $\mathbf{r} = \begin{pmatrix} 5 \\ 5 \\ 5 \end{pmatrix} + \lambda\begin{pmatrix} 1 \\ -3 \\ 2 \end{pmatrix}$.

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8 Show that $\mathbf{r} = \begin{pmatrix} 2 \\ -1 \\ 4 \end{pmatrix} + \lambda\begin{pmatrix} 1 \\ 3 \\ -2 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} 5 \\ 8 \\ -2 \end{pmatrix} + \mu\begin{pmatrix} -2 \\ -6 \\ 4 \end{pmatrix}$ are the same line.

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9 The points $A(0, 1, -1)$, $B(2, 4, 3)$ and $C(6, 10, 11)$ are given. Show that A, B and C lie on a straight line.

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10 Show that the line $\mathbf{r} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} + \lambda\begin{pmatrix} 3 \\ -2 \\ 5 \end{pmatrix}$ is perpendicular to the vector $4\mathbf{i} + \mathbf{j} - 2\mathbf{k}$.

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11 *AQA-style*. The line l_1 passes through the points $A(4, 1, -2)$ and $B(6, -3, 4)$.

(a) Find a vector equation of l_1. [2 marks]

(b) The point $C(k, 7, -11)$ lies on l_1. Find the value of k. [3 marks]

(c) The line l_2 has equation $\mathbf{r} = \begin{pmatrix} 2 \\ 2 \\ 2 \end{pmatrix} + \mu\begin{pmatrix} -3 \\ 6 \\ -9 \end{pmatrix}$. Show that l_1 and l_2 are parallel but are not the same line. [3 marks]

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12 *Edexcel-style*. Relative to a fixed origin O, the line l has equation $\mathbf{r} = (2\mathbf{i} - \mathbf{j} + 5\mathbf{k}) + \lambda(3\mathbf{i} + 2\mathbf{j} - \mathbf{k})$, where λ is a scalar parameter.

(a) Show that the point $P(-4, -5, 7)$ lies on l. (2)

(b) The point Q on l has $\lambda = 4$. Find the exact length of PQ, giving your answer in the form $p\sqrt{q}$. (3)

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